CLAIMS

1. A transcutaneous energy transfer device having an external primary coil to which energy to be transferred is applied, and an implanted secondary coil inductively coupled to said primary coil and connected to apply energy to a subcutaneous utilization device, characterized by the inclusion of a magnetic shield covering said primary winding.

2. A device as claimed in claim 1 wherein said shield is larger than said primary coil.

3. A device as claimed in claim 2 wherein said primary coil has a selected shape and size, and wherein said shield is of substantially the same shape as said primary coil, but of greater size.

4. A device as claimed in claim 3 wherein said primary coil has dimensions x_i in direction i, wherein the shield has a thickness t and wherein the dimensions of the shield in direction i is $X_i \geq x_i + 2t$.

5. A device as claimed in claim 3 wherein said primary coil has a generally circular shape with a diameter d, and wherein said shield has a generally circular shape with a diameter D, where D>d.

6. A device as claimed in claim 5 wherein said shield has a thickness t, and wherein $D \geq d+2t$.

7. A device as claimed in claim 5 wherein the shield is formed of a material having a magnetic permeability relative to free space (μ) and has a thickness (t), where $t \gg D/\mu$.

8. A device as claimed in claim 1 wherein the shield is formed of a material having a magnetic permeability relative to free space (μ), has a major dimension X, and has a thickness (t) where $t \gg X/\mu$.

9. A device as claimed in claim 1 wherein said shield has a plurality of ventilation perforations formed therein.

10. A device as claimed in claim 9 wherein said perforations are formed parallel to the magnetic field direction.

11. A device as claimed in claim 10 wherein said primary coil is substantially circular, and wherein said perforations are a plurality of radial slots.

12. A device as claimed in claim 9 wherein said perforations cover approximately 25% to 75% of the area of the shield.

13. A device as claimed in claim 12 wherein said perforations cover approximately 50% of the area of the shield.

14. A device as claimed in claim 12 wherein the perforations result in a reduction in μ_s for the shield which is roughly proportional to the percentage of perforation area, and wherein the shield thickness is increased so as to maintain the relationship $t \gg D/\mu_s$.

15. A device as claimed in claim 12 wherein all dimensions for the perforations are less than the dimensions of the smallest coil in the device.

16. A device as claimed in claim 1 wherein said shield is flexible so as to be able to conform to the contours of a patient's body.

17. A device as claimed in claim 16 wherein said shield is formed of a low loss magnetic material in a flexible polymer matrix.

18. A device as claimed in claim 17 wherein said shield is formed of a ferrite powder in a silicone rubber.

19. A device as claimed in claim 16 wherein said shield is formed of a plurality of segments of a very high permeability material connected by a porous, flexible material.

20. A device as claimed in claim 19 wherein the spacings between adjacent segments in a direction substantially parallel to the magnetic field direction of the primary coil is less than the dimensions of the smallest coil in the device, and the spacing between adjacent segments in a direction substantially perpendicular to the magnetic field direction is much less than the spacing in said parallel direction.

21. A device as claimed in claim 19 wherein said segments cover approximately 25% to 75% of said shield area.

22. A device as claimed in claim 1 wherein said primary coil generates a magnetic field which is directed both toward and away from said secondary coil and wherein said shield is dimensioned and is formed of a material which reflects most of the magnetic filed directed thereto toward said secondary coil.

23. A device as claimed in claim 19 wherein said segments comprises:
a plurality of segments arranged in one or more concentric rings, each said concentric ring including segments of substantially the same size.

24. A device as claimed in claim 23 wherein said plurality of segments are constructed and arranged so as to form a gap between radially opposing segments in said ring, and wherein said segments further comprises a center disk shaped to fit within said gap.

25. A device a claimed in claim 1, wherein said shield and said primary coil are mounted together to form a primary coil assembly, and wherein a substantially impervious coating is applied to said assembly.

26. A device a claimed in claim 25, wherein said primary coil assembly is vinyl dip coated.

27. A device a claimed in claim 1, wherein said primary coil is operationally decoupled from a drive circuit prior to physical disconnection of electrical contacts through which current is transferred from the drive circuitry to said primary coil, and wherein physical connection of electrical contacts through which current is transferred from the drive circuitry to said primary coil occurs prior to operationally coupled the primary winding to the drive circuit.

28. A device a claimed in claim 27, wherein said primary coil is electrically coupled to the drive circuit via an electrical connector, wherein said electrical connector includes power transfer contacts and anti-arcing contacts, wherein said anti-arcing contacts electrically mate after and break before said power transfer contacts, said anti-arcing contacts electrically connected to control circuitry operationally interposed between the drive circuit from the primary winding.

29. A device a claimed in claim 28, wherein said control circuitry is located in said drive circuitry.

30. A device a claimed in claim 28, wherein said control circuitry is located in said connector.